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Microbial Augmentation for Enhancing Lentil and Field Pea Production in Agricultural Fields

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ABSTRACT

Pulses are healthy, nutritious and rich in protein content and their production promote sustainable agriculture. In this study, different pulses yield were checked under field level trials augmented with microbes plus pesticide under control agro-climatic conditions. Demonstration yield of pulses were calculated and compared with farmers' practices. This study was conducted for the production year 2015-16. The maximum production was observed in lentil (14.0 q/ha) followed by field pea (12.7 q/ha), respectively under control conditions. Front line demonstration experiments results revealed the maximum 44.3% (lentil) and 36.6% (field pea) higher production of pulses over the farmers practice. The increased pulses yield employing demonstrated technology over farmers' field practices revealed that the addition of microbes, pesticides, and control of agro-climatic factors, contribute the higher pulses production.

Keywords: *Agro-climatic factors; Biofertilizer, FLD; Microorganism; Pulses.*

INTRODUCTION

Pulses are an important protein rich component of Indian diet. Due to agro-climatic conditions, India is the largest producer of pulses worldwide. These agricultural crops grow particularly in rain fed areas. Lentil and field pea provide cheap protein source for majority of vegetarian people. The demand for pulses is high, whereas the overall production is less compared to growth in population. International Centre for Agricultural Research in Dry Areas (ICARDA) reported that enhanced pulses production in Eastern states of India strengthened the nutrition of families.

The governments have taken initiative for enhancing yield of such crops employing field level demonstration. The main aim of Front-Line Demonstrations (FLD) is to demonstrate newly released crop production and protection technologies and their management practices at the farmers' field under different agro-climatic regions and farming situations (Singh et al. 2013). However when demonstrating the field level demonstration technology in the farmers' field, it is necessary to study the factors contributing higher pulse yield. The pulses productivity levels of required to be increased substantially from 598 kg/ha to 1,200 kg/ha by 2020 in order to make the nation self sufficient in pulses (Ali and Kumar 2005). Other researchers also studied the role of microorganisms as bioferilizers for increasing the production level of crops employing front line demonstration technology (Singh et al. 2013; Yadav et al. 2016).

Front line demonstration (FLDs) experiments were performed by Krishi Vigya Kendra (KVK), Azamgarh, India during pulses production in year 2015-16. The aim of this study was to increase the pulses yield employing FLD (employing improved variety of pulses seeds + Microbial augmentation (phosphate solublising bacteria (PSB), *Azotobacter* sp., *Rhizobium* sp. *Trichoderma* sp.) + pesticide, and evaluation of other parameters affecting crops yield.

MATERIALS AND METHODS

The effect of microbial inoculation and other parameters on production of pulses were evaluated. A field experiment was conducted by KVK, Azamgarh, Uttar Pradesh and a total sixteen farmers for lentil and field pea were associated respectively, under FLD trial.

In the demonstration, one control plot was also kept where farmers practices was carried out for each pulse. The yield data were determined from both the technological demonstration and farmers practices. The formula given by Samui et al. (2000) was used for calculation of extension gap. The per cent increase in yield under FLD compared to farmers' practices was calculated using the following formula: the percent increase is equal to

$$\frac{\text{Grain yield under FLD} - \text{Grain yield under farmers practice}}{\text{Grain yield under farmers practice}} \times 100$$

However, the extension gap was calculated using the following formula:
Extension gap = Demonstrated yield - Yield under farmer's practice
The statistical analyses were done using Microsoft excel programme.

Results and Discussion

The present study was undertaken to determine the effect FLD technology over farmers' practices for enhancing the production level of pulses. The results indicate that use of improved variety of seed, balance dose of biofertilizer, augmentation of microorganisms such as *Rhizobium, Azotobacter, Trichoderma,* phosphate solubilising bacteria (PSB), insecticide, proper irrigation, and management of others agro-climatic situations enhanced the yield of pulses under FLD technology over farmers' practices (Table 1). Different parameters such as percent potential yield and extension yield were analyzed. Microbial inoculation enhanced the yield under FLD fix nitrogen, phosphorous and makes other nutrients available required for plant growth. However, *Rhizobium* sp. may lose their symbiotic properties when exposed to elevated temperature (Balachander et al 2003).

Table1. *Different conditions for field level demonstration technology for farmers.*

Sl. No.	Pulse	Demonstrated Technology	Area (ha)		No. of farmers/ Field demonstration
			Proposed	Actual	
Pulses					
4.	Field pea	Improved variety of seed+ *Rhizobium+Azotobacter* + Phosphate Solublising Bacteria+*Trichoderma*+ Mancozeb	**5.0**	**2.5**	**16**
5.	Lentil	Improved variety of seed+ Seed+*Rhizobium* +*Azotobacter*+ Phosphate Solublising Bacteria+*Trichoderma*+ Indoxocarb	**5.0**	**2.5**	**16**

Table2. *Comparative performance of pulses production under demonstrated technology and farmers practices*

Crop	Technology Demonstrated	No. of Farmers	Demo. Yield Q/ha			Yield of Check Q/ha	% Increase in yield
			Highest	Lowest	Average		
Field pea	Seed+*Rhizobium*+ Phosphate solublising bacteria+ *Trichoderma* + *Azotobacter*	16	13.9	11.5	12.7	9.3	36.6
Lentil	Seed+*Rhizobium*+Phosphate solublising bacteria+ *Trichoderma*+ *Azotobacter*	16	14.8	13.2	14.0	`9.7	44.3

The results of FLD trials over farmers' practices are presented in Table 2. The results revealed that lentil and field pea yield was better in all trials than farmers' practices. The maximum pulse yield is for lentil (14.0 q/ha) followed by field pea (12.7 q/ha), respectively under controlled agro-climatic conditions. The maximum 44.3% (in lentil) and 36.6% (in field pea) higher pulse production was observed over the farmers practice (9.7 and 9.3 q/ha for lentil and field pea, respectively). Similarly other researchers also employed to demonstrate the increased yield of pulses under FLD (Ali and Kumar 2005; Kirar et al. 2006; Mahetele and Kushwaha 2011).

The increase in pulses production under FLD offers to demonstrate this technology under existing farming situations for better yield. The results clearly indicated that the higher average pulse yield in demonstration plots compare to local farmer practices might be due to these practices viz., timely sowing, use of improved seed variety, use of balanced dose of fertilizer (nitrogen and phosphorus), weed management and plant protection practices (Raj et al. 2013). The proper plant protection measures effectively increased the pulses yield compared to the yield observed under farmers' practices. Biological fertilizers not only support the growth promoting activity by increasing the nutrient uptake in plant but also provide resistance (Bohane and Tiwari 2014). The lesser yield of pulses at farmer's practices might be due to the use poor varieties instead of the recommended high yielding resistant varieties, unavailability of seed in time and lack of awareness (Yadav et al. 2016). Farmers followed broadcast method of sowing against the recommended line sowing and because of this, they applied higher seed rate than the recommended limit (Singh et al. 2014). The combined uses of organic and inorganic fertilizers along with bio based fertilizers have been reported (Yadav et al. 2016) to maintain large-scale yield tasks.

The extension gap was calculated, and the values were 3.4 and 4.3 Q/ha for field pea and lentil, respectively that emphasizes that there is requirement to educate the farmers by several ways for adoption of such high crops yielding technologies. The field demonstration on lentil and field pea was helpful for farmers to increase in pulses yield. Therefore, a strategy should be made for getting the more recommended technologies adopted by the farmers for enhancing the production of crops (Raj et al. 2013; Sharma et al. 2011). Farmers should be aware from such technology for enhancing the crops yield and for sustainable food security in future.

Conclusions

The results of frontline demonstrations showed that microbial augmentation plus addition of pesticide (under controlled agro-climatic conditions) enhanced yield of lentil and field pea effectively. The high benefit suggested the economic viability of the frontline demonstrations for farmers to adopt this technology for increasing pulses yield in agricultural fields.

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